SCIENCE

VOL. 74 FRIDAY, OCTOBER 23, 1931 No. 1921

The Next Twenty Years: PROFESSOR HANS ZINSSER 397

Obituary:

Thomas Alva Edison 404

Scientific Events:

Conferences on the Calendar and on Meteorology; Techno-chemical Lectures of the Mellon Institute; The American College of Surgeons; Gold Medals in Recognition of Work in Yellow Fever; Grants of the American Academy of Arts and Sciences; Appointments of the Carnegie Institution of Washington 405

Scientific Notes and News 408

Discussion:

On a Possible Explanation of the Difference in Wave-lengths of the Spectral Lines of a given Element produced on the Sun and on the Earth: PROFESSOR FERNANDO SANFORD. *Bottom Temperatures in Deep Lakes:* DR. STILLMAN WRIGHT. *Metabolism of Cystine and Methionine:* DR. RICHARD W. JACKSON and RICHARD J. BLOCK. *The Transformation of Carotene to Vitamin A in Vitro:* DR. HAROLD S. OLCOTT and DUANE C. MCCANN. *Conical Snowflakes:* WILLIS W. WAGENER 412

The American Association for the Advancement of Science:

The Host Institution and Hotel Headquarters for the New Orleans Meeting: DR. CHARLES F. ROOS. *Section F (Zoology) at New Orleans:* PROFESSOR GEO. T. HARGITT. *Section E (Geology and Geography):* PROFESSOR KIRTLEY F. MATHER 415

Scientific Apparatus and Laboratory Methods:

An Apparatus for Determining the Purity of Limestone in the Field: DR. PAUL EMERSON. *A Simple, Quick and Inexpensive Method of Preparing Lantern Slides:* P. E. REID 418

Special Articles:

A Natural Copper Deficiency in Cattle Rations: DR. W. M. NEAL, DR. R. B. BECKER and PROFESSOR A. L. SHEALY. *Decrease in Rate of Oxygen Consumption under the Influence of Visible Light on Sarcina lutea:* BORIS B. RUBENSTEIN 418

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

THE NEXT TWENTY YEARS[1]

By Dr. HANS ZINSSER

PROFESSOR OF BACTERIOLOGY AND IMMUNOLOGY, HARVARD UNIVERSITY

INTRODUCTION

THANKS to the new understanding which has pervaded American medicine during the last forty years, the dedication of a great hospital becomes at the same time the foundation of a new educational institution. For of all the beneficent changes which have come with the reorganization of medical education, the home-coming of the schools and hospitals to shelter under the wings of the universities is perhaps the most significant and important. By this, medicine has taken its rightful place as the science of human biology in which the laboratories form the bridge over which thought and method of the fundamental sciences find their way to the arts of the clinic and the operating room. Here in these splendid buildings, in the coming years, countless thousands will find comfort and relief from pain, new hope and the postponement of sorrow. And the old traditions of our profession will be upheld, to apply our wisdom and our best skill to all who may have need of them, regardless of the trivial differences which, under all other circumstances, keep men distrustful and apart. But here, too, the ranks of our profession will be renewed, year after year, with younger men, wiser than we—if wisely you train them; stronger in purposes of kindness and human understanding; learned as we could not be, and more skillful.

In all human affairs there is a curious lag between the acceptance of high principles and the application of such understanding to practical purposes. In politics, to realize this, one need only sit in the gallery of Congress and remember that Plato wrote "The Republic" 2,400 years ago. In religious thought we are nineteen hundred and thirty-one years along, and it is best not to say anything more about it. In medicine, the dependence of progress on the disciplines of chemistry, physics and biology has been impressed upon us since the beginnings of the 19th century; and only now are we finally organized, within great universities, as a technical branch of learning, where

[1] Address given at the dedicatory exercises, the new Lakeside Hospital, Cleveland, Ohio, June 17, 1931.

medicine can be carried forward on the currents of thought which flow from the fundamental sciences.

The real beginning of this new spirit, for America, was made in 1876, when Huxley, at the dedication of the Johns Hopkins, defined the cooperation between universities, medical schools and hospitals, more or less in the form in which these principles are now accepted, after many delays and false starts. Indeed, they have needed so much vigorous reiteration of recent years by Mr. Abraham Flexner that, had not Huxley died when Mr. Flexner was a youth, we might say that in this particular aspect of the problem, by a sort of prophetic inspiration, Huxley had taken the words out of Mr. Flexner's mouth. As it is, we can say that Huxley is great, and that Mr. Flexner is his prophet! I say these things in all admiration, for, having differed in many things from this prophet in the past, now that the smoke of battle is blowing away in the breezes of a new day, I see how much on the whole we owe him as a valiant combatant for first principles.

During the last twenty years we have passed through our period of storm and stress, but they are over and we can say: "The Golden Age which a blind tradition has hitherto placed in the past is here and now before us." Of 166 medical schools which existed in 1910, about 66 are left to-day. And these are educating a sufficient complement of doctors for the needs of our nation, incomparably better in quality than their predecessors. The competence of our faculties, the selection of our students and, above all, our material resources have improved at a rate which no other educational movement has ever experienced in an equal period. Indeed, in regard to physical equipment, those of us engaged in the quiet pursuit of our professions have often listened, with wistful though admittedly short-sighted consternation, to the clattering of the golden cloudbursts on the roof, knowing that they would call us away from our test tubes and microscopes to blueprint and catalogue.

But we are approaching the end of the period of rapid expansion. There will no doubt be other dedications of needed hospitals and medical schools after this one, and though development will not suddenly cease, it will assume a slower tempo. We can look forward, in the near future, to a period of increasing stability during which we must grow into our enlarged opportunities by a greater generosity of effort. The fields of our endeavors have been fertilized with a beneficence and a public confidence unheard of in the history of education. It is the privilege of those of us, who are for a short time their tenants, to till them for the future harvests. And the time has come when we must stop to consider that the problems confronting us demand qualities and methods different in many respects from those most important during the transitional period of growth. The last twenty years have been given to the forging of our tools. During the coming twenty we must learn worthily to wield them.

II

It is with some trepidation that I venture to speak first of questions of administration. The specialist is expected to stick to his last, and the ideal professor is usually regarded as the one who sits in the institutional corner assigned to him, pulling out scientific plums and being otherwise a good boy. But it is apparent even to the academic Jack Horners that the time-honored conception of universities as democracies of scholars—everything else being subsidiary—has changed.

It would be stupid to under-estimate the value of sound administration. It would be ungrateful to withhold acknowledgment for the tact and ability with which unselfish men, often themselves talented scholars, have given their strength wholly to administration during the emergency period. It was natural that adjustment and change should have led to a concentration, in the hands of administrators, of powers which, in times of normal academic development, were lodged in those of the scholars. It was not only natural, it was probably a necessary condition without which the new progress could not have been achieved. But, recognizing this, we should also understand that, with the subsidence of the emergencies of organization, a certain amount of administrative demobilization must be undertaken. When, in a previous address, I insinuated that in our institutions of learning the administrative tail was beginning to wag the academic dog, I was mildly admonished as "captious and unreasonable" by a friendly critic from one of the foundations, who wrongly inferred that I was alluding to the power of the hand that held the purse strings. This power undoubtedly exists, and must probably continue to exist, but it has never, in my own experience, been abused in intra-academic relations. The problem is more subtle than that. Business management there must be, and in such affairs the true administrator is the most valuable guide and adviser a sensible faculty can possess. Deans there must be as well; but a leader in the scholastic sense and an administrator in the sense of material efficiency are not hatched out of the same egg. As Mr. Flexner says: "Efficiency in administration and fertility in the realm of ideas have nothing to do with each other." The budgets must be balanced and this is one function. But educational initiative, influence over appointments, policies of curriculum and university relations are another, which require leadership of another sort, the qualities of a scholar among scholars. If we are to succeed in the coming period of intel-

lectual ripening as we have—thanks to temporary centralization of power during that of material expansion—the two functions must again, to some extent, be separated, and the purely administrative mechanism be carried out mechanically, as is its nature, subsidiary to and under the guidance of leaders whose interests and hearts are primarily with education and sound scholarship, secondarily with management.

For the guidance of an institution the success of which depends upon the imponderable values of spirit and intellect is not the mechanical driving of a machine made of iron and steel. It is more like the riding of a thoroughbred, an organism with a nervous system and a temperament. Any one with strong legs can stay on. But the riding is in the lightness of the hand and the feeling of being one with the horse. We must find our way back, or part way back, to the older conception of academic leadership, avoiding the estrangement between faculty and management which these feverish days of reorganization have threatened to establish. That this can be done without radical changes or great struggle I confidently believe, for it is more a change of point of view than one of actual method. Indeed, in some of the more rapidly stabilizing institutions the force of intellectual tradition is automatically bringing it about. And while the distinction I make appears nothing more than a trivial shifting of emphasis to some of my administrator friends, it is this type of subtle difference that distinguishes the fine from the commonplace in men and in institutions. And the quality of American medicine in the future will, to a large extent, depend upon the decisions we reach now in regard to scholarship and administration, which is to lead and which to follow.

That a solution for this problem is not impossible is apparent in the manner in which, for several hundred years, the German universities have managed to run smoothly under a system of rotating rectors and deans who remain integral and often distinguished members of the teaching force, while the mechanics of institutional government keep the engine in even motion, without exerting any pressure whatever upon scholastic matters. To a certain degree, also, it seems to me, a similar system has from the beginning been not unsuccessful in the Johns Hopkins Medical School. The supervisional influence exerted in the German institutions by the ministry of education would automatically be supplied, with us, by the central university authority.

I feel hopeful, therefore, that in spite of our national overemphasis upon administrative perfection, a simple way can be found to keep our medical schools and hospitals under the intellectual guidance of those most competent to run them, without in any way sacrificing that minimum of orderly management which, like an automobile engine, is most effective when it is least audible.

III

As we approach a state of reasonable stabilization, moreover, and the immediate need of powerful financial support becomes less pressing, it is to be hoped also that there will be a permanent and normal adjustment of the relationship between institutions of learning and the great foundations. These have entered the educational world as a sort of fourth estate, a distinct contribution of American benevolence to the history of education and, so far, almost uniquely American. Except for relatively few institutions, the present favorable conditions of medical schools would have been impossible without them. Their influence has been of incalculable benefit, not only by their splendid munificence but, to an almost equal degree, by their initiation of the serious study of educational methods, critical analyses and suggestions for reform. That Bulletin No. 4 of the Carnegie Reports by Abraham Flexner was the catalyst which started the fermentation that converted the sour state of affairs of 1910 into the clear and strong situation of to-day, no one can sensibly question. But there is equally no doubt that new and important problems have resulted from the creation of a power entirely independent of the organized educational system and capable of great influence over this system by the control of enormous funds. When I expressed this view in 1927, disagreement came from many directions. But after all, we have at the present time some measure by which we can estimate whether or not there was just reason for my apprehensions. The question which ten years ago agitated medical education most violently was that of the "full-time" or "part-time" direction of teaching clinics. The subject was discussed *ad nauseam*. Francis Peabody, in his published letter to Longcope, "The Soul of the Clinic," says: ". . . I have become as tired of the discussions of full-time teaching as I am of discussions of the 18th Amendment." And that the sheep were not all on one side and the goats on the other is clear from the subsequent paragraphs, written by this—perhaps the greatest of the younger leaders of clinical medicine of that time. Yet to-day the medical schools of the following universities—Johns Hopkins, Washington University of St. Louis, Yale, Columbia, Chicago, Cornell, Vanderbilt and Iowa—all of them considerably endowed by the Rockefeller Foundation, have adopted the full-time system more or less in the form advocated by some members of this foundation and opposed by many leaders of the medical profession and by not a few administrators. This may of

course be due to the fact that these institutions have all recognized the greater wisdom of the plan. To some of us, wavering in our belief in Santa Claus, it would appear at least not impossible that willingness to adopt an educational policy may in some cases have been subconsciously influenced by the knowledge that such receptiveness to a new idea could, over night, convert an institution struggling to keep its head above water into an affluent one possessing all the material tools for fine performance and future expansion. Accurate controls in this reasoning—which, as a bacteriologist, I would desire—are lacking, since I know of no institutions that have been offered the money and have refused it. But, on the other hand, I know of others that now have neither the full-time system nor the money.

I have no intention of implying by this that the accepted plan is not an excellent one, though I am strongly of the opinion that it is not likely to produce authoritative figures in clinical medicine comparable to Strümpell, Nothnagel, Neüsser, Kraüs, Friedrich Müller, Widal, Osler, Janeway, Delafield, Shattuck and Walter B. James. Neither do I wish to imply that the motives of the accepting institutions were mercenary ones since, as a reaction to the methods of the old proprietary medical school and as a rigid experiment toward the scientific developments of the clinic, the plan did and does recommend itself to many serious students of medical education. I wish to illustrate by these considerations merely that the indirect power of foundations to stimulate fundamental changes in an educational system is a great one, and that the decisions and opinions of self-perpetuating boards of foundations may determine policies in the most important department of civilized society—namely, its educational system. And it appears to me unlikely that, except by occasional fortunate accident, the judgment of foundation administrators on educational problems can, in the long run, be as wise and sound as that of the teachers who are active in the universities and in whose hands responsibility for the development of this phase of our national life must remain.

As a matter of fact, I have a feeling that time will adjust these difficulties automatically. Permanent agreements between donor and recipient are improbable, and there will be no reason, therefore—as the necessity for financial assistance becomes less pressing—why the universities should not gradually grow away from tendencies they consider erroneous, and again develop naturally, without extraneous influence. And we must grant the gentlemen of the foundations that they are doing their best to draw into their deliberations the wisest consultants they can obtain.

Most of them would probably agree with the view that the future usefulness of the great foundations will greatly depend upon the establishment of a relationship in which, while retaining the power to grant or refuse assistance to specific requests, the foundations will neither directly nor indirectly wield any influence over the initiation of academic policy or over university appointments or investigations.

Granting that such a relationship can be brought about, American education will be enriched beyond that of any other country, by the benevolent impulses that have led to the establishment of foundations.

IV

It takes three or four years to erect a great group of buildings. It takes thirty years to train an investigator or teacher and ten more to ripen him into distinction. It was inevitable that the most difficult problem of our sudden aggrandizement should be that of giving the breath of life to our new institutions with men and women capable of doing them credit. But things have not gone too badly with us in this respect. The gods who take care of children and democracies gave us a few leaders in the dawn of our critical period whose influence guided us when the emergency arose. The pupils of Osler, Delafield, Janeway, Mall, Huntington, Jacobi, Halsted, Shattuck, James, Vaughan and some others have filled the chairs of most of our important schools. Welch, Howell, Abel, Simon Flexner, Hektoen and Theobald Smith are with us still. Under their direct teaching and influence we have drawn freely on the great schools of Europe and have made much of their methods and wisdom our own. To be sure, under the pressure of the transitional period, many brilliant young scholars were sacrificed on the wheels of organization, interrupted in the best years of early production and set to work developing great departments. The younger Ostwald is reported to have said of this: "When the Americans discover that a man is superbly fitted for some type of scientific work, they reward him with a position in which he can no longer pursue it." Deplorable as this has been, it was both inevitable and sound, since it followed the principle that no one can properly direct a department who is not professionally competent in the subject with which it deals. And time will correct this by the simplification of administrative intricacies as stabilization proceeds. Nevertheless, our most difficult problem is still this one of personnel, and it will probably take another decade before the supply of highly trained teachers, clinicians and investigators is adequate for the needs of our new institutions. And to meet this need is one of the highest responsibilities faced by those of us who are privileged to play a small part in this development.

Meanwhile, the reproach is still heard that our best schools are training poor investigators instead of good doctors. In a modified form this complaint is an old one. Francis Bacon says: "Physicians are, some of them, so pleasing and conformable to the humor of the patient as they press not the true cure of the disease; and some others are so regular in proceeding according to science for the disease as they respect not sufficiently the condition of the patient. Take one of a middle temper, or, if it may not be found in one man, combine two of either sort." What the new medical teaching is trying to accomplish is to train for the "middle temper," in which neither the pleasing art nor the procedure according to science shall be neglected.

But the reactionary voices are growing feebler as the quality of our present graduates is being appraised. It is more generally acknowledged that, in a rapidly changing science, the two activities, investigation and teaching, are inseparably linked. True teaching is what Carlyle called "Thought kindling." "How can he teach," he exclaims, "who has no live coal within him, but is all burnt out to a grammatical cinder?" It is true, of course, that occasionally great teachers have made few original contributions. But such men have usually approached their subjects by a method of sifting the right from the wrong which, in itself, is a sort of research into true understanding, and in this way have founded schools of investigation. There have been many of these indirect investigators in the history of medicine. In our own country there have been Osler, Welch and some others who have signed many of their important contributions to the medical sciences with the names of innumerable pupils whose minds were the materials on which they carried out their experiments. There are others at the opposite ends of the scale, to whom the classroom and the student laboratory is an annoying disturbance, and who must hunt alone. But even the greatest of these have pupils and assistants. Only, their methods of teaching take a different form and reach a smaller number of more highly specialized minds. Between the two extremes are the larger number of men and women who are talented investigators and who take keen pleasure and profit from contacts with younger associates intent on similar purposes.

For all these there is room in the modern medical school and hospital. There is no room, however, for those to whom the act of instructing is a mechanical thing; who are content to shuck down to the feeding herd the dry hay of old harvests. For medicine, like all biology, is in a strange stage of development at which the pupil is often wiser than his master. Few men on the faculties, except perhaps a small group of the biochemists, are as well grounded in the fundamental contributory sciences as the most gifted of their students. To do our difficult duty to these disciples we must remain students ourselves and be capable not only of telling them what is known to-day, but of pointing out to them the goals they may attain which a too short life has placed beyond our reach. We must teach beyond ourselves. "Über dich hinaus sollst du zeugen," as Nietzsche said. If we perform our allotted tasks in this sense, these young men and women will gain from us not merely the meager store of to-day's understanding but, from our curiosities and our laborious efforts to conquer a little of to-morrow, they will gather velocity to carry them farther than we can hope to go. Less than this is not true teaching.

And it is at the present stage of our development that this type of relationship between teachers and the taught is of particular importance. The rapidity with which the exacter sciences of chemistry, physics and mathematics are penetrating medicine makes collaborators of the experienced biologist and the younger student who comes fresh from the fundamental laboratories. As much error can be committed by the premature attempt to apply exact mathematical reasoning, accurate enough in simple systems, to the complex processes of living matter, as by neglecting available physico-chemical knowledge in the biological approach. The two methods are dependent upon the same kind of reasoning. But while the more exact sciences gain much of their information by creating their own conditions of study in systems sufficiently simple to permit absolute conclusions, nature fixes the conditions which the biologist must investigate. It is only when, by his trial and error experimentation, he has isolated a set of phenomena that the chemist or physicist can profitably take hold. It is more important than ever before, therefore, that teachers and pupils should regard themselves as overlapping, consecutive generations of students whose relationship must be, for the service of knowledge, quite different from that of the old pedagogic one of less actively advancing eras.

Of course there are certain cornerstones and retaining walls of accepted fact that must first be laid. This is, or should be a simple mechanical affair—easily arranged. Real teaching begins at the jumping-off place.

V

But in this matter of research there is still much that awaits adjustment. The very point of view which I have expressed has placed a premium on the mere activity of investigative effort regardless of its intelligence or results. We have developed the habit of judging men for positions by the perusal of the titles of their publications, and a list three pages long is more formidable than one of a few lines. There is

also a peculiarly sensational and sentimental appeal in medical discovery, and we are living in an age in which cheap performance, skilfully vulgarized, may have an enormous advertising value. And institutional rivalry, bidding for support, has had a tendency to foster the submission of results to public and inexpert applause before they have been passed upon in the rigid forum of technical criticism.

There has been, in consequence, a hot-house forcing of medical investigation which, together with some very brilliant and useful growth, has nourished the weeds of much second-rate material. There has also developed a curious halo about research which has exalted it above other and, in the absence of talent, more useful and less expensive methods of occupying time.

These tendencies have been further intensified by the strange circumstance—peculiar to our present development—that, for the time being, available funds have often outstripped our abilities to use them wisely. In the fields of cancer and tuberculosis particularly, high-minded philanthropists have hoped that money could engender ideas, instead of being merely the fertilizer which can aid the sprouting of the living seed of a thought. For this reason, to-day, much work is undertaken merely to justify expenditure; and, in well-equipped laboratories, many a man and woman is patiently sitting on a lifeless idea, like a hen on a boiled egg, or is spending time and money transposing into complicated notations old tunes that have been adequately played in C major.

Undoubtedly a certain amount of such gnawing at dry bones is inevitable, since pedantry—not strong enough to shove a spade into the rich soil of new fields—has ever been attracted to the dust-bin. And also there must be trial and error in regions of thought in which the unknown is so vast compared with the narrow paths of the known. And the most intelligent endeavors may lead into blind roads from which retreat is the only return to the highway.

To reduce such waste to the necessary minimum, and to prevent the vulgarization of science by the introduction of a spirit of rivalry and réclame is largely the responsibility of all of us, old and young, who are privileged to cooperate in hospitals and schools. It is not only a matter of teaching and studying in the manner which I have indicated, nor is it entirely one of doing our own work honestly and with modesty. It is necessary, in addition to this, to maintain a strong consciousness of the dignity of this type of occupation and freely to encourage into it only those of whose talents and training, and above all, of whose reverence for truth we are convinced. Especially must we not lose the spontaneity of our reactions of joyous admiration for a good job well done by another, and of contempt for cheap performance. Finally, though abandoning none of our critical faculties, we must be extraordinarily careful not to become so academically conservative, as our vessels grow harder, that we extinguish, with a flood of doctrinaire convictions, young thoughts too original and foreign to accepted theory for our own ready comprehension.

This part of it is the task of those of us who are working in the ranks—a heavy one and a difficult program in which few of us can hope entirely to succeed. In this regard, however, we may look into the future with confidence, because in a constantly increasing number of the newly organized institutions there are growing up groups of younger men whose training has been far sounder than our own and whose standards are certainly as high.

But there are other factors involved in the situation which are at least of equal importance, and which, with the passage of time and stabilization, will have a decisive influence. When buildings and equipment have been provided with a splendor sufficient to satisfy the most chauvinistic local pride and the ambitions of executives, the funds which subsequently become available will, let us hope, be freed for the development of the flesh and blood of universities—men and budgets. And may the wise administrator be wary of accepting funds for special projects dear to the hearts of donors—cancer, tuberculosis, institutes of human relations, eugenics, etc.—and encourage the accumulation of unrestricted gifts. Scientific thought, like poetic inspiration, must be allowed to circle indefinitely, like a carrier pigeon, to find its own direction of flight. We believe that in many American institutions large funds are relatively sterile because they can be used only for definite purposes in which progress, impossible for the time being, awaits ideas and methods not yet available. And the great strength of Trinity College, in Cambridge, would seem to lie in its command over large and unrestricted resources with which it can permanently support a group of mature and distinguished scholars who can explore wherever the trails of curiosity lead them.

Let us not forget that Archimedes had the idea of specific gravity while taking a bath; that Descartes was lying in bed when he evolved coordinate geometry, and that Isaac Newton—though I don't believe it, is said to have drawn deep deductions first in an apple orchard. On the other hand, I do not wish to be misunderstood as meaning to sponsor the policy that universities should pay men large salaries for taking baths, lying abed and drowsing under apple trees.

VI

Devotion and good sense are not lacking in our in-

stitutions and many of the matters of which I have spoken are growing pains which will not, if recognized early and energetically treated, affect our hearts. Our great asset is the increasing number of young men and women, who in a commercial age and in a country of wide opportunity are offering themselves for our work. Partly, this is due to the higher type of pre-medical education, partly to the careful selection of material by medical schools, and again to the cultivation of that type of teaching which I have outlined. Also, however, I feel confident, it is due to the growth of a spirit of enthusiasm and idealism in many of the present generation of students which is perhaps one of the wholesome reactions against the exaggerated materialism of the last twenty years. Our responsibility then is not only to train and select but also to create conditions which will hold the enthusiastic and talented in the clinic and the laboratory. This is to a large degree already attained by the opportunities for work that our new institutions provide. To a greater degree, however, it is also an economic question. And this brings me to the sordid problem of salaries.

The complaint that we can not expect to recruit the best brains of the country into academic life, owing to the meager economic future offered in these occupations, is to some extent justified in fact. Not so long ago science in America was a calling at which one could not make a living until after death. Conditions have rapidly improved and should still improve considerably, especially in the cases of the middle grades—mature men and women who should not be forced to leave important work in well-organized places merely because only one living salary is provided in the budget for the director of the department. But unfavorable comparisons of academic remuneration with the enormous incomes of industrial administrators, corporation lawyers and bootleggers are quite beside the point. The answer of the future will perhaps be that the incomes of scientists will moderately increase, but surely that the exaggerated wages of some other occupations will diminish. For an academic salary of ten or twelve thousand dollars is a more normal social phenomenon than one of a hundred thousand for the manufacture of chewing gum or the authorship of a romantic advertisement for a mouth wash. This is a matter of opinion. It is an easily calculable fact, however, that the universities can never hope to compete with business or the practicing professions in this respect, simply because there is not enough money in the country to make this possible. Though in a few instances attempts seem to have been made in this direction in order to "put over" the full-time clinical plan, I believe this to be an abnormal phenomenon of artificial development which will pass with another generation. But were it possible for universities to enter in this financial competition for brains, would it be necessary or even desirable?

It is just, of course, that academic pay should be respectably adequate to provide the legitimate needs of a cultivated family of moderate size. There is such a thing, however, as being civilized beyond the necessity of great wealth. And those who have attained this level of personal civilization know that they must choose in the sense of the Chinese philosopher Yang Hon, who said: "The man who thinks only of amassing riches is not humane; and he who thinks only of leading a humane life shall not be rich."

There are passing through the hospitals and universities of this country more youngsters who subscribe to this doctrine than any one knows except those of us who are daily at work with them. Most of them have thought it over and come to the conclusions which Carlyle paraphrases from Confucius: "If the search of great riches were certain of success—though I become a groom with whip in hand to get them, I will do so. As the search may not be successful, I will follow after that which I love."

The temper of that type of mind which is attracted to the sciences and the arts is usually emancipated from the obsession for quick riches which other occupations are so apt to strengthen. These young men and women that come to us in annually greater numbers are attracted to our calling because a higher type of training and better opportunities for work have aroused their spirits. They have no ambition for great financial success. They are willing to forget about this entirely if they can be offered rewards sufficient to permit them to live lives of normal human relations—marriage, children, books and the pride of economic independence—not only after middle age has brought recognition, but in the formative and most productive years—which now are the most trying and full of disturbing anxieties. All this—and it is not expensive—is within the possibilities of the financial resources of our present university medical schools. And, given this, there are more of these young men and women of force and ability than most people know, who deliberately choose the great adventure of trying to write something of themselves by their own work and thoughts into the records of time.

And, in our profession, in addition to the intellectual appeal, there is the legitimate one of a humane impulse—directly or indirectly to aid in alleviating sorrow and sickness and even, by some fortunate combination of chance, labor and clear thinking, once in so often to parry the scythe of death.

We are confronted with many problems and many

responsibilities for these coming twenty years. But the last twenty have put the tools into our hands. We need have no fear of failure if we remain sturdy in our trusts and put our faith in the younger generation.

And here in Cleveland you are again expressing this vigorous faith in the future which has characterized the entire history of the Western Reserve—a faith which inspires the undertaking of great beginnings which you know will be carried on eventually by younger hands in the high spirit with which they were begun. In this great and splendid institution, in which all the humane and benevolent forces of your city are cooperating you will solve all the problems that may arise from the rapidity of development which renders our own era of medicine a difficult but a particularly fascinating one. You may, at times—with all of us—fail to strike that delicate balance between the practical things of life and the more intangible qualities of spirit and intellect, which must be found in order that our profession may continue to perform its full functions in the service of civilization. These temporary fluctuations which occur in all difficult human undertakings are like the swinging from right to left of a vessel in the wash of a heavy sea—but they make no deviation from the eventual true course when wise and vigorous hands are on the wheel. You know where you are going, your course is charted, and you have already a great tradition to drive you forward.

Of few things can we foretell the future. In these days of world transformations no one can foresee the events that are to come. No man can much affect them except by lifting his hand and mind honestly to the tasks that lie immediately before him. But in this is our profession more blessed than all others. Whatever the changes or trials that an uncertain future may hold, nothing can alter the intrinsic purposes of medicine, the very definition of which must be stated in words of action, to increase in wisdom and skill for the relief of suffering and the solace of sorrow—to serve men, their bodies and their minds—indiscriminately in a spirit that transcends social, racial and national distinctions. In all the rivalries and hatreds and mutual distrusts that hold the political and economic world in a grip of terror, medicine has no part. It is the one activity that, through these years of upheaval and revaluation of ideas and institutions, has had no need to alter its standards or its aspirations; it has known no enmities and recognized no national boundaries. Epidemic, sickness, physical suffering wipe out all this, and unite all men in sympathy and human equality. And all those in the world whom a kind fortune has permitted to devote themselves to this profession, rejoice and are grateful for the work you are inaugurating to-day.

OBITUARY

THOMAS ALVA EDISON

1847–1931

THOMAS ALVA EDISON died in the early morning of October 18. From the tributes from many sources printed by *The New York Times*, the following from Mr. Hoover and from a number of scientific men are quoted:

It is given to few men of any age, nation or calling to become the benefactor of all humanity. That distinction came abundantly to Thomas Alva Edison, whose death in his eighty-fifth year has ended a life of courage and outstanding achievement. His lifelong search for truth, fructifying in more than a thousand inventions, made him the greatest inventor our nation has produced, and revolutionized civilization itself. He multiplied light and dissolved darkness; he added to the whole wealth of nations. He was great not only in his scientific creative instinct and insight but did more than any other American to place invention on an organized basis of the utilization of raw materials of pure science and discovery. He was a rare genius. He has been a precious asset to the whole world.

Every American owes a personal debt to him. It is not only a debt for great benefactions which he has brought to every American, but also a debt for the honor he brought to our country. By his own genius and effort he rose from a newsboy and telegrapher to the position of leadership among men. His life has been a constant stimulant to confidence that our institutions hold open the door of opportunity to those who would enter. He possessed a modesty, a kindliness, a staunchness of character rare among men. His death leaves thousands bereft of a friend, the nation bereft of one of its notable citizens and the world bereft of one of its greatest benefactors. I mourn his passing as a personal friend over a quarter of a century.—HERBERT HOOVER, President of the United States.

It has seldom fallen to any one man to be of such service to humanity. The world mourns a great benefactor.—SAMUEL W. STRATTON, chairman of the corporation of the Massachusetts Institute of Technology (dictated a few minutes before his own death).

I think his reputation was great outside America. One could not go anywhere in the world where he was not considered the greatest inventor and help to mankind. He was kind and considerate and a good friend.—G. K. BURGESS, director of the Bureau of Standards.

In my opinion Mr. Edison had a greater influence on the world than any other American.—KARL T. COMPTON, president of the Massachusetts Institute of Technology.

Edison, through his discovery of how to preserve the spoken word, made man and himself immortal. What greater is possible in practical achievement?—ROBERT A. MILLIKAN, California Institute of Technology.

At the dawn of the electrical age, a little over fifty years ago, Edison appeared like a heaven-sent pioneer. His burning enthusiasm and undaunted courage and perseverance succeeded in creating in 1882 the incandescent electrical lighting system, which has not experienced an essential change since that time. This was his greatest achievement and entitled him to immortality.—MICHAEL PUPIN, Columbia University.

Edison was truly one of the great Americans. His contributions to science have been outstanding.—JOHN C. MERRIAM, president of the Carnegie Institution of Washington.

Thomas Edison used science for the benefit of mankind to such a high degree, and brought science and the scientific method into such high repute in the public regard, that it is an open question which of these two great contributions to modern civilization is the greater. Certain it is, that no other man of our generation has made a larger or more inspiring contribution.—VERNON KELLOGG, permanent secretary of the National Research Council.

With the insight of genius Edison made trial and error combined with industrial organization a method of research. He was one of the greatest men America has produced, leading in the applications of science to industry that have made possible a new civilization based on democracy, universal education and general welfare. —J. MCKEEN CATTELL, editor of SCIENCE.

America has lost one of its most famous citizens and the world one of its greatest benefactors. In a very real sense Edison was the founder of our electric era. What a fine thing it would be if such a useful and inspiring personality could be granted a span of life commensurate with his value and usefulness to the world. If so, Edison would have lived for ages.—EDWIN W. RICE, JR., honorary chairman of the board and former president of the General Electric Company.

Edison was doing—and is doing—more to advance our human affairs and interests than any one I know. I repeat "is doing" because his example of actively trying to lift us continually a peg higher in our civilization by strenuous personal effort is now actuating countless youth of all lands.—WILLIS R. WHITNEY, director of the Research Laboratory of the General Electric Company, Schenectady.

Edison demonstrated to the world the enormous practical importance of electric power and its applications. Few men have ever benefited more of their fellow-men. —IRVING LANGMUIR, associate director of the General Electric Research Laboratory.

Among all the people of the earth no name has been mentioned with greater admiration than that of Thomas A. Edison, the greatest inventor of his time. An adequate appreciation of all Mr. Edison's merits can not be encompassed in brief space, but this much can be said here: not only his work but his personality especially was of sublime grandeur.—OSCAR VON MÜLLER, Deutsches Museum, Munich.

In Edison the world loses one of the greatest technical geniuses who ever lived. Though Edison himself very often equated genius with application, we know that his successes can not be accounted for by application alone. In Edison intuitive thought and exact weighing of all technical and economic problems were united with unparalleled perseverance in pursuit of his problems to such a degree that thereby he became for us the archtype of inventor.—AUGUST CAROLUS, the University of Leipzig.

The passing of Edison is a great loss to the world and especially to science and industry. Not only was the world indebted to Edison for innumerable creations of his own brain, but for his aptitude in adapting to practical purposes the ideas of other inventors, which but for him would have remained impracticable.—THE DUC DE GRAMMONT, Paris.

With the passing of Edison one of the world's greatest benefactors leaves us. What he has done for business, pleasure and philanthropy can not easily be calculated. But some idea of what the world would be without his inventions, his self-sacrificing labors, can be gathered if we try to live for a day in busy centers without the use of the telephone. He was a great and constant inspiration to me throughout my life.—GUGLIELMO MARCONI.

In Edison, one of the great technical inventors to whom we owe the possibility of alleviation and embellishment of our outward life has departed from us. An inventive spirit has filled his own life and all our existence with bright light. Thankfully we accept his legacy, not only as a gift of his genius, but also as a mission placed in our hands. For to the new generation falls the task of finding the way for the right use of the gift given to us. Only if it solves this task will the new generation be worthy of its inheritance and become really happier than former generations.—ALBERT EINSTEIN.

SCIENTIFIC EVENTS

CONFERENCES ON THE CALENDAR AND ON METEOROLOGY

PROFESSOR CHARLES F. MARVIN, chief of the U. S. Weather Bureau, was a representative of the State Department at the fourth general Conference of the Committee on Communications and Transit of the League of Nations, which met at Geneva, Switzerland, on October 12. This designation was in response to a request from the League of Nations that this country be represented at the conference, especially in connec-

tion with the question of the simplification of the calendar, which is one of the agenda.

Professor Marvin is vice-chairman of the National Committee for the United States on Simplification of the Calendar, which is an unofficial committee consisting of representative men and women interested in the improvement of the present calendar. His attendance at this conference was as an expert observer for the State Department and not as chief of the Weather Bureau.

In addition to attending the meetings of the League of Nations committee, Professor Marvin attended, as chief of the Weather Bureau, the meetings of the International Meteorological Committee and a meeting of the executive council of that committee. These meetings were held at Locarno beginning on October 5.

The International Meteorological Organization, which consists of the directors of all the meteorological services of the world, meets every six years. The International Meteorological Committee is a subcommission of the major body and has 21 members. Its meetings are held on the call of the president, usually every two years. There is an executive council, composed of five members, which is charged with the conduct of the administrative affairs of the main body. Professor Marvin is a member of both the subcommission and the executive council. This year these are meeting at the same time at Locarno.

The program of the International Meteorological Committee consists of the consideration of the reports of the president, secretary and other officers, as well as meteorological subjects, among them being that of the polar year program. One of the items to be handled by the executive council is that of selecting a permanent secretary of the major organization, the headquarters of which are to be in Switzerland. The secretariat is supported by the various governments concerned.

TECHNO-CHEMICAL LECTURES OF THE MELLON INSTITUTE

Two series of lectures on important subjects in industrial chemistry and chemical engineering are being presented by technologic specialists of the Mellon Institute of Industrial Research during 1931–32. These discourses are delivered on Mondays, from 10:30 A. M. to 11:30 A. M., throughout both semesters, in the fellows' room of the institute, and are open to all students of industrial chemistry and chemical engineering in the University of Pittsburgh, as well as to the institute's members.

The introductory lecture was given on September 28 by Dr. Edward R. Weidlein, director of the institute, on "The Field and Opportunities of the Chemical Engineer." The first series of lectures entitled "Some Important Chemical Engineering Materials, Their Manufacture, Properties, Uses, and Evaluation" is being given on the following dates:

October 5, Mr. H. J. Rose, "Coke"; October 12, Mr. R. F. Ferguson, "The Manufacture of Refractories"; October 19, Mr. S. M. Phelps, "The Properties and Uses of Refractories"; October 26, Mr. C. H. Geister, "The Manufacture, Properties and Uses of Lime"; November 2, Mr. Tracy Bartholomew, "The Manufacture, Properties and Uses of Portland Cement"; November 9, Mr. R. H. Heilman, "Heat-Insulating Materials"; November 16, Mr. J. D. Alley, "Abrasives"; November 23, Dr. S. A. Braley, "Iron and Steel"; November 30, Dr. A. W. Coffman, "Corrosion-Resistant Materials"; December 7, Dr. W. W. Duecker, "Sulphur"; December 14, Mr. R. R. McClure, "Rubber."

The second series include: "Lectures on Professional Opportunities in Various Industries—What the Chemist and Chemical Engineer Have Done, are Doing, and can Probably Accomplish in these Fields," and will be given as follows:

January 4, Dr. F. P. Lasseter, "Hydrometallurgy"; January 11, Mr. H. H. Meyers, "Fertilizers"; January 18, Mr. E. J. Casselman, "Glass"; February 8, Mr. E. W. Reid, "Solvents"; February 15, Dr. P. B. Davidson, "Paper"; February 29, Dr. R. N. Wenzel, "Fatty Oils and Soaps"; March 7, Mr. E. R. Harding, "Foods"; March 14, Mr. C. F. Goldthwait, "Textiles"; March 21, Dr. H. K. Salzberg, "Paints"; April 4, Dr. A. G. Loomis, "Petroleum Production"; April 11, Dr. H. E. Foote, "Industrial Gases"; April 18, Dr. G. J. Cox, "Sugar"; April 25, Dr. J. J. Enright, "Bacteriology, Chemistry and Public Health"; May 2, Dr. O. F. Hedenburg, "Insecticides and Fungicides"; May 9, Dr. George D. Beal, "Pharmaceuticals"; May 16, Dr. L. H. Cretcher, "Synthetic Medicinals."

THE AMERICAN COLLEGE OF SURGEONS

DR. J. BENTLEY SQUIER, professor of urology at the College of Physicians and Surgeons, Columbia University, and director of the Squier Urological Institute of Presbyterian Hospital, was elected president of the American College of Surgeons for next year at the recent New York meeting. He will be inducted into office to succeed Dr. Allen B. Kanavel, of Northwestern University, at the next annual meeting, the date and place of which have not yet been determined. As its next vice-presidents the college elected Dr. C. Gordon Heyd, professor of clinical surgery and attending surgeon at the New York Post-Graduate Medical School and Hospital, and Dr. W. Edward Gallie, surgeon-in-chief of the Toronto General Hospital.

At the concluding session on October 16 three honorary fellowships and 647 regular fellowships were conferred and an address to the initiates was given by Dr. Allen B. Kanavel, president of the college.

The honorary fellowships were conferred upon Professor Dr. Hans von Haberer, of Cologne, Germany; Professor Arthur Henry Burgess, of Manchester, England, and Sir Charles Gordon-Watson, of London.

An unanticipated part of the ceremony was the conferring upon Dr. Franklin H. Martin, "father" and director of the American College of Surgeons, of the title of "commendatore" of the Crown of Italy. The decoration was bestowed by Emmanuele Grazzi, Italian Consul General, who said that it was upon the proposal of Premier Benito Mussolini and by order of the King of Italy in recognition of Dr. Martin's services to Italy through the organization of a base hospital during the war. Dr. Martin already holds the Distinguished Service Medal and the Order of St. Michael and St. George from the British government.

Dr. H. H. Ogilvie, of San Antonio, Texas, received the college's annual "Case History Prize Award" of $500 for the surgeon who keeps the best record of case histories.

On the roster of 647 new fellows of the college, elected from 1,490 applicants, were seven Canadian surgeons, two in Australia, one in China, one in England, one in Guatemala, one in India, two in Mexico, one in Panama and two in Siam.

GOLD MEDALS IN RECOGNITION OF WORK IN YELLOW FEVER

THE *Associated Press* reports that after thirty years the Government of the United States has bestowed the full measure of recognition on the late Dr. Walter Reed and his associates in the war on yellow fever during the years 1900, 1901 and 1902.

The awards voted two years ago by the Congress were dispatched on October 2 to survivors of Dr. Reed's volunteers, and to the heirs of others. At least six of the bestowals, including that for Dr. Reed himself, were posthumous.

They consisted of a gold medal with the name of the recipient on one side and the words "Conquest of Yellow Fever" on the back. Congress also awarded to a number of volunteers pensions of $125 a month.

In addition to that for Major Reed, the posthumous awards were for the following:

Dr. Aristides Agramonte, who died recently at New Orleans, where he was head of the School of Tropical Medicine of the University of Louisiana.

Major James Carroll, survived by his wife, St. Petersburg, Florida.

Jesse W. Lazear, widow, Berkeley, California.

Edward Weatherwalks, widow, Pompton Lakes, New Jersey.

Warren G. Jernegan, widow, last known address, Charleston, South Carolina.

William H. Dean, address unknown, born in Holland, Ohio, enlisted in Grand Rapids, Michigan.

Other medals went to the following:

John H. Andrus, Elmira, New York.
John R. Bullard, Cuba.
A. W. Covington, Cohocton, New York.
Wallace W. Forbes, Minneapolis.
Levey E. Folk, Columbus, Ohio.
Paul Hamann, East Moline, Illinois.
James L. Hanberry, address unknown, born Denmark, South Carolina.
John R. Kissinger, Huntington, Indiana.
John J. Moran, Mexico City.
William Olsen, Los Angeles.
Charles G. Sonntag, Jackson, South Carolina.
Clyde L. West, Toledo.
Dr. R. P. Cooke, Virginia.
Thomas M. England, Washington, D. C.
James Hildebrand, Atlanta.

Those who received pensions also were Hamann, Kissinger, Olsen, Sonntag, West, Hildebrand, Andrus, Covington, Forbes, Folk, Hanberry, England, the widow of Private Weatherwalks, Bullard, Cooke and Moran.

GRANTS OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES

AT a meeting of the council of the American Academy of Arts and Sciences on October 14, the following appropriations were made from the Permanent Science Fund, administered by the academy.

To Dr. Leonard S. Hsu, of the Princeton-Yenching Foundation, $1,000, to aid in his study of population problems in China and to help in the publication of the results therefrom in English.

To Dr. J. L. Conel, of Boston University Medical School, $200, to aid in the collection of embryos of the eel.

To Dr. Edgar Altenburg, Rice Institute, Houston, Texas, $500, for assistance in prosecuting his investigations on the effect of ultra-violet light on the germ plasm of *Drosophila melanogaster*.

The Permanent Science Fund Committee of the American Academy of Arts and Sciences will receive requests for grants in aid of scientific research in the physical sciences, the natural sciences, and the social sciences. There is no restriction as to the type of research for which these grants will be made, but special attention will be given to requests for small sums where the acquisition of such funds will make it possible for investigators to carry out researches in cases where it would be difficult or impossible without some such aid.

The next meeting of the committee will be held on the fourth Tuesday in April, 1932. Requests for grants should be sent to Professor E. M. East, chairman, Bussey Institution, Forest Hills, Massachusetts, by March 15, 1932.

APPOINTMENTS OF THE CARNEGIE INSTITUTION OF WASHINGTON

DR. H. A. SPOEHR has resigned as director of natural sciences of the Rockefeller Foundation and has resumed his former association with the Carnegie Institution of Washington as chairman of the division of plant biology, with headquarters at the central laboratory of this division, at Stanford University, California.

Dr. Jens Clausen, of the Royal Veterinary and Agronomic Laboratory, Copenhagen, has been appointed cyto-geneticist to the staff of the division of plant biology. Dr. Clausen is now carrying on his work in association with Dr. H. M. Hall at the central laboratory of this division, at Stanford University.

Dr. Robert W. Bates, of the department of physiological chemistry of the University of Chicago, has undertaken studies, beginning on October 1, as an associate of Dr. Oscar Riddle, staff member of the department of genetics of the institution, at Cold Spring Harbor, Long Island.

Dr. W. H. W. Baade, of the Hamburg Observatory, has been appointed astronomer at the Mount Wilson Observatory, dating from October 1, 1931.

Dr. Joel Stebbins, director of the Washburn Observatory of the University of Wisconsin, has undertaken service as a research associate of the institution, for the purpose of collaboration in studies of stellar photometry at the Mount Wilson Observatory.

SCIENTIFIC NOTES AND NEWS

THE National Academy of Sciences will hold its autumn meeting at Yale University, New Haven, beginning on November 16. At this meeting Dr. W. W. Campbell will preside, having been elected to the presidency in succession to Dr. T. H. Morgan.

THE executive committee of the American Association for the Advancement of Science will hold its regular fall meeting at the Cosmos Club in Washington on Sunday, October 25, with a forenoon and an afternoon session.

DR. SAMUEL WESLEY STRATTON, chairman of the corporation of the Massachusetts Institute of Technology, previously professor of physics at the University of Chicago, founder and first director of the National Bureau of Standards and president of the Massachusetts Institute of Technology, died suddenly from heart disease on October 18 at the age of seventy years.

THE John Fritz gold medal, conferred by the four national societies of civil, mining and metallurgical, mechanical and electrical engineers, has been awarded for 1932 to Dr. Michael I. Pupin, professor of electromechanics and director of the Phoenix Research Laboratory at Columbia University, for his achievements as "scientist, engineer, author, inventor of the tuning of oscillating circuits and the loading of telephone circuits by inductance coils."

DR. GEORGE E. HALE has been elected president of the International Council of Scientific Unions, the new name of the International Research Council. He succeeds M. Picard. Sir Henry Lyons remains general secretary.

AT the recent centenary meeting of the British Association for the Advancement of Science, Sir Alfred Ewing, lately principal and vice-chancellor of the University of Edinburgh, was elected by the general committee president of the association for next year, when the meeting will be held at York. The new members of the council are Dr. J. Drever, Professor T. E. Gregory, Professor H. S. Hele-Shaw, Professor E. B. Poulton and Professor A. M. Tyndall.

AT the reception held at the University of London on September 28 to celebrate the centenary meeting of the British Association, the degree of doctor of science was conferred on General Jan Christiaan Smuts, F.R.S., president of the association; Professor Sir Frederick Gowland Hopkins, F.R.S., Sir Charles Scott Sherrington, O.M., F.R.S.; Lord Rutherford, O.M., F.R.S., and (*in absentia*) Sir Joseph John Thomson, O.M., F.R.S.

DR. JAMES ROWLAND ANGELL, president of Yale University, who was made "Chevalier" of the French Legion of Honor in 1930, has been promoted to the rank of "Officier."

DR. ALICE HAMILTON, assistant professor of industrial medicine at the Harvard School of Public Health, was given a special dinner at the recent meeting of the American Public Health Association.

DR. RUSSELL M. WILDER has resigned his position as professor of medicine at the University of Chicago to join the staff of the Mayo Clinic and the faculty of the Mayo Foundation Graduate School of the University of Minnesota as professor of medicine.

DR. KARL T. WAUGH, head of the department of psychology at Long Island University, has been elected president of Dickinson College.

DR. ELIJAH SWIFT, Williams professor of mathematics and head of the department in the College of Arts and Sciences, University of Vermont, has been made dean of the college, succeeding Dean George H.

Perkins, who has retired after a service of thirty-three years.

DR. E. N. JONES, head of the department of botany of Baylor University, at Waco, Texas, has been made acting dean of the college of arts and sciences.

DR. KENNETH A. KOBE, of the University of Minnesota, has been appointed instructor in chemical engineering at the University of Washington. He will have charge of the work in industrial chemistry in place of Dr. H. K. Benson, who is in Washington, D. C., for the year in charge of the division of chemistry and chemical technology of the National Research Council.

DR. RAYMOND L. TAYLOR has been appointed assistant professor of biology at the College of William and Mary and will give courses in botany and in entomology. Last year Dr. Taylor filled a temporary appointment as instructor of entomology in the New York State College of Forestry, Syracuse University.

THE University of Alabama School of Medicine announces the following new appointments: Dr. Allen D. Keller, professor of physiology and pharmacology, from the Yale University School of Medicine; Dr. Franklin S. DuBois, assistant professor of anatomy and acting executive of the department, from the University of Chicago; Dr. Gene H. Kistler, assistant professor of physiology and pharmacology and assistant in medicine, from the University of Chicago; Dr. Marie C. D'Amour, instructor in physiology and pharmacology, from the University of Chicago. The following promotions have been made: Dr. Ralph McBurney, professor of bacteriology and hygiene and assistant in medicine; Dr. Allen W. Blair, assistant professor of pathology and bacteriology and instructor in surgery; Dr. Eleanor A. Hunt, assistant professor of microscopic anatomy; Dr. Luny V. Ragsdale, assistant clinical professor of medicine; Dr. John McLaughlin Forney, assistant clinical professor of obstetrics.

CARL W. MITMAN is curator of the new division of engineering in the U. S. National Museum, formed in July by combining the divisions of mineral and mechanical technology. In this new division the section of mechanical technology is under the supervision of Frank A. Taylor, assistant curator; the section of aeronautics is under Paul E. Garber, assistant curator, and the section of mineral technology is under the immediate supervision of Mr. Mitman.

DR. J. S. WIANT has resigned from the staff of the Wyoming State Agricultural Experiment Station to accept the position of associate pathologist with the division of horticultural crops and diseases of the U. S. Bureau of Plant Industry. He is stationed at the U. S. Market Pathology Laboratory in New York City.

DR. WARREN FALES DRAPER, assistant surgeon general in the federal service, has been appointed commissioner of health in Virginia.

COLONEL CHARLES P. ECHOLS, professor of mathematics at the U. S. Military Academy at West Point, retired from the U. S. Army on October 1.

PROFESSOR WILLEM DE SITTER, director of the Leiden Observatory, will lecture under the Trask Foundation at Princeton University on October 27 on "The Size of the Universe." Dr. Edwin P. Hubble, of the Mount Wilson Observatory, will give four lectures under the Vanuxem Foundation at Princeton on October 29 and 30, and on November 2 and 3, on the general subject of the nebulae.

PROFESSOR HENRY E. SIGERIST, professor of the history of medicine and director of the Institute of the History of Medicine of the University of Leipzig, has been appointed visiting lecturer in the history of medicine at the Johns Hopkins University School of Medicine for the present year. Professor Sigerist will be at the Johns Hopkins University during October and November, and will give a series of lectures and courses.

DR. ARTHUR E. KENNELLY, professor emeritus of electrical engineering at Harvard University and the Massachusetts Institute of Technology, has gone to Japan. At the invitation of the Institution of Electrical Engineers of Japan, he will deliver a series of lectures during November, before five Japanese universities, as the first visiting American professor under the Iwadare Foundation.

DR. J. MCKEEN CATTELL, editor of SCIENCE, returned to New York on October 13, after attending the centenary meeting of the British Association for the Advancement of Science in London as the delegate of the American Association.

DR. A. R. MOORE has returned to his post at the University of Oregon after an absence of a year which he spent in Europe as a fellow of the C. R. B. Educational Foundation. While abroad Dr. and Mrs. Moore worked at different times in the marine stations at Roscoff and Naples, and in the university laboratories at Brussels and Innsbruck.

DR. JOHN H. BRADLEY, professor of geology at the University of Southern California, has returned from a field expedition in the Inyo Mountain range with a collection of starfish fossils.

UNDER a special fellowship of the Charles Lathrop Pack Forestry Foundation, Professor Svend Heiberg,

of the department of silviculture, New York State College of Forestry, a graduate of the Copenhagen and Yale Forestry Schools, has left for a four-months forest study trip in Europe. Professor Heiberg has been engaged during the last three years in examining the development of forest plantations in the State of New York and in order to supplement that work he will survey recent developments in the production of forests in Europe.

MISS MALVINA HOFFMAN, sculptress of New York and Paris, who has been commissioned by the Field Museum of Natural History to make more than 100 life-size figures, busts and heads representing all the principal races and types of mankind, has left Chicago after conferences with officials of the museum, for a trip around the world. During this trip she will make studies in the various countries from living models. The figures, which will be in bronze, will form a principal feature of a projected new hall in the museum—the Chauncey Keep Memorial Hall—which is to be devoted to the living races of man. Miss Hoffman recently completed a European trip during which she made a number of plaster casts and bronzes for the museum.

DR. A. DEFRISE, associate professor in the anatomical Institute of the University of Milan, recently a research fellow of the Rockefeller Foundation working at the Johns Hopkins University, returned to Italy on October 15, taking with him a number of Wistar Institute albino rats of the experimental colony strain to start a colony at Milan for research purposes.

A MEETING of the American section of the International Astronomical Union will be held in Washington, D. C., after the close of the meeting of the American Astronomical Society, December 28–30. New statutes of the section in conformity with the new statutes of the union will be proposed by the executive committee. It does not plan to appoint technical committees of the American section as was done in preparation for the last two meetings of the union. Members of the standing committees of the union are invited to submit to the executive committee, through the secretary, Professor Raymond S. Dugan, Princeton, any matters which they wish to have considered at the meeting.

THE Society of American Bacteriologists will hold its annual meetings in Baltimore from December 28 to 30, inclusive, under the presidency of Professor J. Howard Brown, of the Johns Hopkins Medical School. There will be a general scientific session in the form of a series of papers on "Bacterial Dissociation and Life Cycles." The program of the section on medical bacteriology and immunology is practically completed with symposia on (1) hemolytic streptococci, (2) meningococcus, and (3) immunological aspects of anterior poliomyelitis and of typhus fever.

THE Radiological Society of North America will hold its seventeenth annual meeting in St. Louis from November 30 to December 4, with headquarters and meeting place at the New Jefferson Hotel. Dr. Edwin C. Ernst is chairman of the local committee on arrangements.

THE forty-fifth annual convention of the Association of Land-Grant Colleges and Universities will be held at the Stevens Hotel, Chicago, from November 16 to 18. As in previous years, representatives of the land-grant colleges and the U. S. Department of Agriculture will attend this convention, to discuss various questions relating to agricultural education, research and extension, including also engineering and home economics. The president of the association is Dr. G. W. Rightmire, president of the Ohio State University, Columbus, and the secretary-treasurer is T. P. Cooper, dean of the Kentucky College of Agriculture and director of the Kentucky Agricultural Experiment Station and of the extension service, Lexington. The chairman of the executive committee is Dr. R. A. Pearson, president of the University of Maryland, College Park.

THE Grasselli Medal meeting of the Society of Chemical Industry will be held on November 6, at 8:30 P. M., at the Hotel New Yorker, with the American Chemical Society, the Electrochemical Society and the Société de Chimie Industrielle. Nonmembers are invited to attend. Ample space has been provided to accommodate a large attendance in addition to those who attend the dinner preceding it. At this meeting the Grasselli Medal will be presented to Dr. L. V. Redman. The program will be as follows: "Accomplishments of the Medallist"—F. W. Willard; "Presentation of the Grasselli Medal"—D. D. Jackson; "Research as a Fixed Charge"—L. V. Redman. The dinner preceding the meeting will be served at 7:00 P. M. Reservations should be made with Mr. Irving Hochstadter.

ACCORDING to a special dispatch to the *New York Times*, from Ithaca, New York, dated October 15, element No. 87, one of the two hitherto unknown components of the universe, has been discovered by Dr. Jacob Papish, professor of spectroscopy at Cornell University, in a substance known as samaroskite, a lustrous velvet black mineral found in Norway, Siberia and in some southern states of this country. Of the ninety-two elements only No. 85 now remains unidentified. Assisted by Mr. Eugene Wainer, a graduate student from Akron, Ohio, and aided by a grant

from the Heckscher Foundation for the Advancement of Research, Professor Papish has definitely identified the new element and has secured a spectrogram of it. Repeated checks have confirmed its existence and a full report is expected to be made to the National Academy of Sciences when it meets in New Haven next month.

Nature prints the following radiogram, dated Sept. 28: "Experimental demonstration of spin of light.—The depolarization of Rayleigh scattering of monochromatic light in carbon dioxide gas does not diminish to one quarter of its value when spectroscopically separated from rotational scattering, as demanded by existing theories of radiation. The actual observed diminution, from 10 per cent. to 6 per cent., is quantitatively explicable, assuming that common light consists of spinning quanta possessing one Planck unit of angular momentum.—C. V. Raman and S. Bhagavantam."

A GROUP of psychologists and economists, headed by Dr. Nicholas Murray Butler, president of Columbia University, and Dr. James Rowland Angell, president of Yale University, will take part in weekly academic lectures to be broadcast by the National Advisory Council on Radio in Education. These broadcasts on present-day economics and psychology were started on October 17 over the network of WEAF. Thirty leaders in their respective fields of economics and psychology will speak. An economist and a psychologist will speak fifteen minutes, respectively, in each program. The broadcast will be on Saturday nights from 8:30 to 9 o'clock. Dr. Butler opened the series on October 17. He was followed by Dr. Angell, who discussed "Psychology To-day, its Relations to Other Sciences and Social Problems." Dr. Ernest L. Bogart, president of the American Economic Association, will open the radio course in economics with an address on "Forerunners of the Present Depression." There will be thirty lectures in each series. The first ten addresses in the economics series will deal with the causes and solution of the economic depression. Others who will lecture later are Miss Jane Addams, of Hull House; Dr. Edwin F. Gay, professor of economic history, Harvard; Dr. Walter R. Miles, president of the American Psychological Association; Dr. Edward S. Robinson, professor of psychology, Yale University; Dr. Robert S. Woodworth, president of the Social Science Research Council, and Dr. Arnold Gesell, director of the Clinic on Child Development, Yale University.

A NEW school of archeology and museum has been established at Las Vegas under the supervision and control of the New Mexico Normal University. Mr. J. I. McCullough, teacher of history of the Southwest courses at the Normal University during the past year, has been appointed director and organizer of the school.

THE College of Medicine of the University of Illinois opened on October 5. All departments are now housed in the new buildings. These buildings will accommodate 200 students in each class. The laboratories are contiguous with the Research and Educational Hospital which has a capacity of 500 beds. Three hundred and sixty of these beds are occupied at the present time and are used exclusively for research and teaching purposes. In addition to the Research and Educational Hospital, the large State Department for Juvenile Research is closely affiliated with the College of Medicine and offers a wealth of material of border-line and subnormal cases which are of great value in psychological and neurological studies. A Psychiatric Institute with 62 beds and an Orthopedic Institute for Children with 100 beds have also been opened. It has been necessary to limit the number of dispensary patients to 100,000 per year. The library and reading rooms have been enlarged to keep pace with the growth of the college. Reading rooms have a seating capacity of 500. The library has over 40,000 volumes which includes complete files of practically all clinical and biological research journals.

THE construction of the largest and most complete establishment in the world devoted to research on wood has been started by the U. S. Department of Agriculture in the form of a new fireproof building for the Forest Products Laboratory at Madison, Wisconsin, the contract for which is the principal award under a $900,000 Congressional appropriation to provide the laboratory with adequate quarters and equipment. Better utilization of forest materials and broader markets for forest products are the objectives for which government research workers will use the new facilities. In its six stories, with total floor space of 175,000 square feet, the building will contain modern technical and scientific facilities for testing and investigating wood and other forest products in manifold uses and transformations, from logs, poles and lumber to pulp, paper and turpentine.

BERNARR MACFADDEN, publisher and physical culture and health propagandist, has donated $5,000,000 to form the Bernarr MacFadden Foundation, a charitable corporation for the perpetuation of physical culture and health building. The $5,000,000 and the income from it will be spent, according to the certificate of incorporation, to maintain and conduct institutions, establish scholarships, maintain sanitariums, gymnasiums, camps and other recreational facilities, and to promote hygiene and health and the physical well-being of young men and women. The work of the foundation, the certificate says, is to be conducted prin-

cipally in the United States, "but is not restricted thereto."

THE London *Times* reports that Professor Maiuri, superintendent of excavations in the Campania, has been granted funds from the British Government for carrying out excavations on the island of Capri. He proposes to reveal and display, so far as possible, the ancient topography of the island, as it was in the Roman era. The many Roman buildings which lie buried and have only been partially excavated so far are to be laid bare, the roads of access to them are to be made more practicable, and a general work of embellishment undertaken so that the ruins may be presented in a setting worthy of their past glory. In the days of the Emperor Tiberius there were twelve palaces in the island, named after twelve gods, and the emperor is supposed to have lived in a different one during each month of the year. The most important of these is the Villa Jovis, which lies at the extreme eastern point of the island overlooking the Sorrentine Peninsula. It is built on a peak, and from the cliffs on which it stands there is a sheer drop of about 700 feet to the sea. It is on the ruins of this palace that Professor Maiuri began work early in October.

THE U. S. Bureau of Fisheries is making a study of fish migration in the waters of the Chesapeake Bay. Dr. John C. Pearson, assistant aquatic biologist, who has been stationed at Annapolis for the purpose of clamping identification bands on any fish which he can obtain for labeling and liberation purposes, tagged a rockfish and released it off Hackett Point, Annapolis. Two days later the same fish was caught about thirty miles up the bay, near the mouth of the Seneca River. Other fish bearing the identification tags have been caught in the vicinity of Havre de Grace and the Northeast River. Thus far the results of the study show a tendency of the fish to make for the head of the bay.

THE Chilean Nitrate of Soda Educational Bureau has again made provision for the Chilean Nitrate of Soda Nitrogen Research Award. These awards were designed to foster search on the rôle of nitrogen in economic crop production. Any research worker in the United States or Canada is eligible. In selecting candidates for the award attention is given to both the merits of research already accomplished and to the promise for future work. The award is administered by the nitrogen research award committee of the American Society of Agronomy. The amount of the award is decided by the committee in each individual case. Any one wishing to call the attention of the committee to their own work or that of any other worker should communicate before November 1 with the chairman of the committee, Dr. Richard Bradfield, Department of Soils, Ohio State University, Columbus, Ohio. The award will be made at the annual meeting of the American Society of Agronomy in Chicago, on November 19 and 20.

DISCUSSION

ON A POSSIBLE EXPLANATION OF THE DIFFERENCE IN WAVE-LENGTHS OF THE SPECTRAL LINES OF A GIVEN ELEMENT PRODUCED ON THE SUN AND ON THE EARTH

IT has been shown that all electric charges on the earth are due to a potential difference between an insulated body and the electrostatic field in which it is immersed.[1] When this potential difference changes, the magnitude or the sign, or both, of the charge on the insulated body changes. It is immaterial and sometimes not discoverable whether the change in potential difference is due to a change in the electron content of the insulated body or to a change in the electrical state of the surrounding field.

Since the potential of the earth's electrostatic field changes with a change of altitude above the earth, the charge of an insulated body will change as its altitude in the earth's electrostatic field changes. This fact was discovered by Paul Erman in 1803,[2] though it was not interpreted in this manner. Erman believed the charges upon his electroscope to be induced by the charge of the earth, but we know that no insulated body can have a charge induced upon it. The most that can happen to it by induction is to have a redistribution of its charge over its surface.

An uncharged, insulated body when raised above the earth acquires a negative charge. If retained in that position and put into electrical contact with the earth it loses its negative charge. If then lowered to the earth it acquires a positive charge. If raised to a greater height than before without discharging its positive charge it again becomes negatively charged.

If two small insulated spheres be charged, one positive and one negative, to a potential difference from the earth of 100 volts each, they will then attract each other with a force proportional to the product of their opposite charges. Let them be raised to a height where the potential of the earth's field is 100 volts positive to the earth. One of the spheres will then be charged to a negative potential of 200 volts and the other will be uncharged. There will be no attraction due to the product of their charges.

[1] *Bulletin* of the Terrestrial Electric Observatory of Fernando Sanford, Vol. 6, p. 8, and "Terrestrial Electricity," p. 100.

[2] Gilbert's Annalen, 15, 386 (803).

Let them now be raised to a height where the potential of the earth's field is 200 volts positive. One sphere will now be charged negative to a potential of 300 volts, and the other will be negatively charged to a potential of 100 volts. They will now repel each other with a force proportional to the product of their like charges. This was virtually Erman's fundamental experiment.

Suppose a negatively charged particle to be in orbital revolution about a positively charged particle near the surface of the earth. Other conditions remaining unchanged, the frequency of revolution will change with every change of the product of their opposite charges. The same will be true for other forms of oscillation of the two particles; hence any change in their altitude above the earth will cause a change in their vibration frequency.

If the same laws apply within the atom, the wave-lengths of its spectral lines will vary with a change of potential of the electrostatic field in which it is placed. Thus, if the electrostatic field of the sun is different from that of the earth, the wave-lengths of the spectral lines in the sun's electric field will be different from those of the same kind of atom in the earth's field. We know that they are appreciably different.

We believe that the Fraunhofer lines in the solar spectrum are due to the absorption of gases at different elevations above the photosphere. Accordingly, these gases are differently charged. May not the broadening of some of the absorption lines be partly due to this cause?

FERNANDO SANFORD

PALO ALTO, CALIFORNIA

BOTTOM TEMPERATURES IN DEEP LAKES[1]

ALMOST without exception, published accounts of temperature cycles in lakes fail to mention the effect of pressure on the temperature of water at maximum density. That increased pressure lowers the point of maximum density has been known to physicists for half a century. Results obtained by various workers are not in complete agreement. According to Amagat[2] the lowering effect is in the neighborhood of 0.0235° C. per atmosphere, although the relationship is probably not strictly linear. Since a depth of 10.33 meters corresponds roughly to one atmosphere of pressure, it follows that deep lakes may have bottom temperatures below 4.0° C. in summer. A number of such observations have been made in this country and many more have been made elsewhere.

The first observations in North American lakes which have come to the attention of the writer were made in Lake Superior during August, 1871.[3] Most of the bottom readings were 3.8°or 3.9°; two very low readings were obviously erroneous. Yoshimura,[4] in a recent review of this subject, reported a temperature of 3.7° at 300 m for Lake Ontario in the same year, but the source of the data is not evident. Drummond[5] reported temperatures in Georgian Bay in 1886 which were well below the minima possible according to the calculations of Amagat. In the summer of 1889 he found 3.7° at 128 m and 3.9° at 115 m on different days and at different stations. In 1911 Hamberg,[6] noting similar records from European lakes, pointed out that they could be explained by the effect of pressure on the temperature at maximum density.

In Crater Lake, Kemmerer et al.[7] found 3.5° at 600 m, and all temperatures at 100 m or deeper were less than 4.0°. Kindle[8] reported 3.3° at 96 m and 1.1° at 130 m in Lake Ontario in late September. These readings are so low that they must be regarded as errors, and they cast doubt upon the accuracy of a reading of 3.9° at 121 m at another station.

During the summer of 1930 a large number of temperature observations were made from the Bureau of Fisheries vessel *Fulmar* in Lake Michigan. Of 26 readings in water over 100 m deep, nine gave 3.9°, one gave 3.8°, and the others were 4.0° or more. One station showed 3.9° water from a depth of 75 m to the bottom at 145 m. The greatest depth at which observations were made was 168 m and lower temperatures may be expected in the deepest part of the lake (264 m).

Summer temperatures below 4.0° have not been reported for Lake Erie or for Lake Nipigon. The same is true of Lake Tahoe,[5] with a depth of 501 m. Obviously very deep lakes can have bottom temperatures well above the minima possible under pressures corresponding to their depths.

While the number of lakes showing bottom temperatures below 4.0° in summer is not large and the lower temperatures probably have little biological significance, the phenomenon is worthy of mention, even in elementary texts. Ignorance of it may lead an inexperienced observer to question the accuracy of his thermometers.

STILLMAN WRIGHT

U. S. BUREAU OF FISHERIES,
ANN ARBOR, MICHIGAN

[1] Published by permission of the U. S. Commissioner of Fisheries.

[2] E.-H. Amagat, *Ann. Chim. et Phys.*, (6), 29: 570, 1893.

[3] W. R. Nichols, Proc. Bost. Soc. Nat. Hist., 21: 53, 1880–1882 (1883).

[4] S. Yoshimura, Umi to Sora, 10 (12): 423, Kobe, 1930.

[5] A. T. Drummond, Can. Rec. Sci., 4: 77, 1890.

[6] A. Hamberg, Pet. Geogr. Mitteil., 57 (12): 306, 1911.

[7] G. Kemmerer, J. F. Bovard, and W. R. Boorman, Bull. Bur. Fish., 39: 51, 1923.

[8] E. M. Kindle, Trans. Roy. Soc. Can., 19: 47, 1925.

METABOLISM OF CYSTINE AND METHIONINE

THE fact that methionine is similar to the indispensable amino acid, cystine, in containing sulfur lends considerable interest to the fate of methionine in the animal organism as well as to any possible metabolic interrelation of these two protein units. We have investigated the effect of the administration of racemic methionine to albino rats ingesting food presumably deficient in cystine. The basal diet contained whole milk powder at a low level with a supplement of gelatin. It was found that, whereas the administration of other amino acids, serine and alanine, as well as certain derivatives closely related to cystine, produce a negligible or at most a very minor acceleration in growth, the addition of either cystine *or methionine* to the diet produces an *unmistakable* increase in body weight. The conclusion that methionine may satisfy an animal's cystine requirement might be drawn from these experiments. However, we prefer at this time to postpone final interpretation of the findings until we have carried out further experiments to throw more light upon the phenomenon in question.

RICHARD W. JACKSON
RICHARD J. BLOCK
LABORATORY OF PHYSIOLOGICAL CHEMISTRY,
YALE UNIVERSITY

THE TRANSFORMATION OF CAROTENE TO VITAMIN A IN VITRO

MOORE[1] and CAPPER[2] have been able to demonstrate the transformation of carotene to vitamin A in rats. More recently, the conversion has been observed in the fowl.[3] If the reaction is enzymatic, it should be possible to transform carotene to vitamin A *in vitro*.

Preliminary experiments indicated that carotene was destroyed and that vitamin A appeared when carotene was incubated with fresh liver tissue, obtained from vitamin A-deficient rats. Ultra-violet absorption spectra of the ether extracts of such mixtures showed a band at 325 μμ, characteristic of vitamin A, while the ether extracts of the livers without carotene addition were without absorption at that wave-length.

The following experiments verified the supposition that an enzyme was responsible for the reaction. Two rats which had ceased to grow on a vitamin A-free ration were killed, their livers extirpated, and ground with sand and water. After standing for 24 hours at 37°, the extract was filtered. One portion of the liver extract was extracted with ether. An ultra-violet absorption spectra photograph of the extracted material showed no absorption at 325 μμ, indicating that the liver extract contained no vitamin A.

Another portion of the liver extract was added to a few cubic centimeters of a colloidal solution of carotene in water, the mixture was incubated for 36 hours and extracted with ether. The ether extract was colorless, there was a definite band at 325 μμ, and none at 340 μμ, at which wave-length carotene itself absorbs. A third portion of the liver extract was boiled for one minute, then treated with carotene as before. After incubation, the ether extract was yellow, the absorption spectrum showed no band at 325 μμ, while the band at 340 μμ was still present. The enzyme, which should be called "carotenase," had been destroyed by the heating.

HAROLD S. OLCOTT
DUANE C. MCCANN
LABORATORIES OF BIOCHEMISTRY AND ANALYTICAL CHEMISTRY,
STATE UNIVERSITY OF IOWA

[1] T. Moore, *Biochem. Journ.*, 1930, 24, 692; 1931, 25, 275.
[2] N. S. Capper, *Biochem. Journ.*, 1930, 24, 980.
[3] N. S. Capper, I. M. W. McKibbin, and J. H. Prentice, *Biochem. Journ.*, 1931, 25, 265.

CONICAL SNOWFLAKES

THE account by Professor A. D. Moore, in SCIENCE for June 12, of the fall of conical snowflakes at Ann Arbor recalled similar conical flakes or stones which I observed at what was then the Great Basin Forest Experiment Station above Ephraim, Utah, in September, 1920. The station is situated on a small bench at 8,750 feet elevation in the Wasatch Mountains and during the latter part of the summer is subject to short but intense rain or hail squalls. On one occasion, however, the precipitation, instead of being in the usual form of rain or round hail, consisted of cones of hard compacted snow. The bases of the cones were hemispherical, giving the stones the general outline of an inverted parachute. In size they ranged larger than those observed by Professor Moore, all being over one quarter inch across the base and many of them reaching one half inch. The fall was accompanied by a strong wind from the northeast and lasted only a few minutes.

I took no notes on the phenomenon at the time and can no longer remember just what the weather was, preceding the fall, but I recollect that the wind which accompanied the squall was cold. The stones were so dense and landed with such force that we were compelled to take shelter, but in composition they were packed snow and not the ice of ordinary hailstones.

WILLIS W. WAGENER
U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
SAN FRANCISCO, CALIF.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE HOST INSTITUTION AND HOTEL HEADQUARTERS FOR THE NEW ORLEANS MEETING

TWENTY-SIX scientific societies have signified their intentions of meeting with the American Association for the Advancement of Science at its New Orleans meeting, from December 28, 1931, to January 2, 1932. This meeting, the eighty-ninth of the American Association, will be held under the presidency of Dr. Franz Boas, of Columbia University. Tulane University will be the host institution. Professor D. S. Elliott, the chairman of the local committee for the New Orleans meeting, has supplied the following information regarding the host institution:

The Tulane University of Louisiana was organized as the Medical College of Louisiana in 1834. In 1845, the state constitution established the University of Louisiana with the departments of law, medicine and natural sciences and letters. In 1882, Mr. Paul Tulane, of Princeton, New Jersey, formerly a resident of New Orleans, donated his property in New Orleans for educational purposes to a board of administrators who organized themselves as the Tulane Education Fund. This donation, with subsequent gifts, amounted to $1,050,000. In 1884, by an act of the legislature of Louisiana of that year, the existing University of Louisiana was transferred to this board and the name was changed to The Tulane University of Louisiana. In 1886, Mrs. Josephine Louise Newcomb donated $100,000 to establish the H. Sophie Newcomb Memorial College as the women's department in the university. She added largely to her original endowment, and by her will bequeathed about $2,700,000 additional.

The university comprises the following departments: The College of Arts and Sciences, the College of Engineering, the H. Sophie Newcomb Memorial College for Young Women, the Graduate School, the College of Law, the College of Medicine (including the Schools of Medicine and Pharmacy, the Graduate School of Medicine, and the Dental Clinic), the College of Commerce and Business Administration, the Courses for Teachers, the School of Social Work, the Department of Middle American Research, and the summer schools. The College of Engineering includes courses in mechanical and electrical engineering, civil engineering, chemical engineering and architecture. Newcomb College includes, in addition to the usual college courses, the Schools of Art and Music.

The campus of ninety-two acres, with its imposing buildings, faces Audubon Park, one of the most beautiful parks in the South. There are thirty-one buildings, many of which have been erected in recent years. Among these are Gibson Hall, the Physics Building, the Richardson Chemistry Building, the Science Building and Annex, Stanley Thomas Hall and the Old Engineering Building, the Richardson Memorial Medical Building, the Tilton Memorial Library, the Dining Hall, the Academic Dormitory, the Richardson Memorial Medical Dormitory and the Gymnasium. The following buildings of the H. Sophie Newcomb College for Women are on that part of the campus facing Broadway: Administration Building, Art Building, Swimming Pool and Gymnasium, and Nos. 29, 43 and 57 Newcomb Campus and the following dormitories for women: The Josephine Louise House, Doris Hall and the Warren Newcomb House. Dixon Hall, one of the newer buildings, provides a fine auditorium seating about one thousand persons; class, office and practice rooms for the Newcomb School of Music, and in a wing a library, reading room and stack room.

The third and fourth year medical students, as well as the students of graduate medicine, are taught in the new Hutchinson Memorial Building on Tulane Avenue, which is opposite the great Charity Hospital, the unrivaled facilities of which are used in their instruction. This building, which cost with equipment approximately $1,250,000 provides the necessary classrooms and laboratories and furnishes a better distribution of space than the old building on Canal Street, as well as more adequate equipment for this work. The new building, however, is intended to do much more than this. In it will be operated out-patient clinics for the various medical branches. These clinics will be arranged and conducted for the purpose of teaching medical students the practical treatment of patients in preparation for their future work. The building has been erected on the property purchased by the university in the square adjacent to the Charity Hospital on Tulane Avenue. The building provides suitable quarters for the Graduate School of Medicine, the Dental Clinic and the Orleans Parish Medical Society.

The College of Commerce and Business Administration holds its day and night courses in Gibson Hall. The other departments of the university consisting of the Colleges of Arts and Sciences and Engineering, the Graduate School, the College of Law, the first and second years of the School of Medicine and the classes of the School of Pharmacy are conducted in the buildings located on the campus on St. Charles Avenue, opposite Audubon Park, in the city's handsomest resi-

dential district, with the exception of the Newcomb College buildings.

The dormitories for students of Newcomb College for Women are located on that part of the campus of the university occupied by the Newcomb College buildings, facing Broadway. The Josephine Louise House, known as The Residence, on the corner of Broadway and Plum Streets, has accommodation for about 190 students, together with the refectory and a special lunch room in the basement for day students. The building is modern in every respect and fireproof. Doris Hall is located at the corner of Newcomb Campus and Willow Street. It was opened for occupancy at the beginning of the session 1925–26. It is a thoroughly commodious and well-equipped brick and stone building of two stories and a basement. It houses twenty-five students of moderate means who are willing to help reduce the cost of their college education by cooperative effort. The Warren Newcomb House, accommodating fifty-two students, was occupied with the beginning of the session 1928–29. It is a two-story and basement structure of reinforced concrete and brick, located on Newcomb Campus next to Doris Hall.

The American Mathematical Society and the Mathematical Association of America will have their headquarters at the Sophie Newcomb dormitories. Other societies' headquarters will be located in the hotels, some of which are world-renowned. Society hotel assignments, together with information concerning the hotels, are as follows:

Roosevelt: University Place, near Canal Street. All rooms with bath. Single rooms, $4.00 to $6.00 per day; double rooms, $6.00 to $9.00 per day.

General headquarters for the association.
American Physical Society.
American Society of Zoologists.
American Society of Parasitologists.
Society of Petroleum Geophysicists.
Econometric Society.
Metric Association.

St. Charles: St. Charles Ave., Common and Gravier Streets. Single rooms, $2.00 and $2.50 per day; (with bath) $3.00 to $5.00 per day; double rooms, $3.50 to $4.00 per day; (with bath) $5.00 to $7.00 per day.

Botanical Society of America.
American Phytopathological Society.
American Society of Plant Physiologists.
American Society of Naturalists.
American Society for Horticultural Science.
American Microscopical Society.
Ecological Society of America.

Marbero: Canal and Loyola Streets. All rooms with bath. Single rooms, $3.00 to $3.50; double rooms, $4.00 to $6.00 per day.

Entomological Society of America.
American Association of Economic Entomologists.
American Nature-Study Society.

Jung: 1500 Canal Street. All rooms with bath. Single rooms, $3.50 per day; double rooms, $5.00 to $6.00 per day.

American Society of Agronomy.
Society of American Foresters.

De Soto: Baronne and Perdido Streets. Single rooms, $2.00 per day; (with bath) $2.50 to $3.00 per day; double rooms, $3.00 to $4.00 per day; (with bath) $3.50 to $5.00 per day.

American Meteorological Society.
Potato Association of America.
Wilson Ornithological Club.

Monteleone: Royale and Iberville Streets. Single rooms, $2.00 per day; (with bath) $3.00 to $3.50 per day; double rooms, $3.00 to $3.50 per day; (with bath) $5.00 to $6.00 per day.

Southern Society for Philosophy and Psychology.

La Salle: N. Rampart and Canal Streets. Single rooms, $2.00 per day; (with bath) $3.00 per day; double rooms (with bath) $4.00 to $5.00 per day.

Phi Sigma Biological Research Society.

Bienville: St. Charles Avenue, at Lee Circle. All rooms with bath. Single rooms, $3.00 to $3.50 per day; double rooms, $4.50 to $6.00 per day.

Honor Society of Phi Kappa Phi.

Chalmette: 808 Carondolet Street. Single rooms, $1.50 to $2.50; (with bath) $2.00 to $2.50; double rooms (with bath), $3.00 to $4.00.

Ponchartrain Apt. Hotel: 2031 Charles Street. All rooms with bath. Single rooms, $3.00 up; double rooms, $5.00 up; suites, $10.00 up.

All the above hotels are very centrally located and within convenient walking distance from any one to the others and to the Municipal Auditorium, where many of the general sessions will be held. All are convenient to direct transportation lines to Tulane University.

We are assured that a sufficient number of rooms will be reserved by these hotels to accommodate those who will attend the New Orleans meeting, but in order to save possible disappointment members are urged to make their reservations at once. These should be sent directly to the hotel selected.

Further information regarding the New Orleans meeting will be given from time to time in short announcements in SCIENCE and in the special issue of SCIENCE containing the regular preliminary announcement. This latter will appear during the last of November.

CHARLES F. ROOS,
Permanent Secretary

SECTION F (ZOOLOGY) AT NEW ORLEANS

AT the New Orleans meeting, section F of the American Association for the Advancement of Science and the American Society of Zoologists will hold sessions for the reading of papers on Tuesday, Wednesday

and Thursday, December 29, 30 and 31. Following the policy of recent years the program will be arranged with formal reading of papers in morning sessions and informal demonstration presentation in afternoon sessions. Those who expect to contribute should indicate which type of presentation they prefer. All contributed papers will appear in the program of the American Society of Zoologists, Section F holding no separate sessions for the reading of papers. The address of the vice-president of the section, Dr. Robert W. Hegner, entitled, "How the Other Half Live," will be given immediately following the annual zoologists' dinner on Wednesday evening.

The business session will come on Wednesday afternoon at 2 o'clock, immediately preceding the business session of the society. Hotel headquarters for both groups will be the Roosevelt Hotel. All rooms have baths and range upward from $4 for single rooms and $6 for double rooms. Reservations for hotel accommodations should be made early by members, directly with the hotel and not through secretaries or local committee. Other hotels are available, a list of which will be given in an early issue of SCIENCE, in the preliminary announcement of the American Association for the Advancement of Science. Arrangements have been made for the usual railroad rates of a fare and a half on the certificate plan and will be specially announced in the preliminary announcement of the permanent secretary of the association. In securing transportation buy a first-class, one-way ticket, and obtain for each ticket a certificate for the "New Orleans Convention of the American Association for the Advancement of Science and Associated Societies." Present this certificate at the registration offices in the Venetian Room of the Roosevelt Hotel immediately upon arrival, and call for it at the same place the next day; a half-fare returning ticket may be procured after obtaining this validated certificate. A registration fee of $1.00 for members of the association and $2.00 for others will be charged. Return Pullman reservations on trains should be arranged for shortly after arrival.

Members of Section F who desire to present papers should send the exact title and an abstract of not more than 250 words to reach the secretary not later than November 1; titles received later than this can not be placed on the program and titles without abstracts will not be considered or accepted. Indicate in what group (cytology, embryology, parasitology, protozoology, comparative anatomy, general physiology, etc.) the paper is to be read and whether charts or lantern slides will be used. The rules of the American Society of Zoology are followed in arranging the program and conducting the sessions; members are limited to a total time of fifteen minutes, whether for one or several papers, and the time of a person introduced by a member is included within the fifteen-minute limit.

The titles and abstracts should be sent as early as possible, preferably to the secretary of the American Society of Zoologists (Dr. William H. Cole, Rutgers University, New Brunswick, N. J.) or to the secretary of the section.

GEO. T. HARGITT

DUKE UNIVERSITY,
DURHAM, N. C.

SECTION E (GEOLOGY AND GEOGRAPHY)

SECTION E (Geology and Geography) of the American Association for the Advancement of Science will meet in New Orleans on Friday, January 1, for its annual session. The chairman for the meeting is Professor Douglas W. Johnson, of Columbia University, who will deliver his address as retiring vice-president that afternoon, and the secretary is Professor Kirtley F. Mather, of Harvard University. A regional committee under the chairmanship of Professor R. A. Steinmayer, of Tulane University, has been organized, and a symposium on the "Geology of the Gulf Coastal Prairies" is planned for the afternoon meeting. The annual dinner for geologists and geographers will be held on Friday evening: Titles and abstracts of papers for the symposium should be submitted to Professor Steinmayer prior to November 10; titles and abstracts of other papers for this meeting should be submitted to Professor Mather prior to November 15.

Saturday, January 2, will be devoted to a field trip to the salt domes and mines of the Teche country. Those taking the trip will board a Pullman in New Orleans, after the dinner on Friday evening, for New Iberia, Louisiana, and may return to New Orleans on Saturday evening. Those interested in the field trip should communicate directly with Professor Steinmayer at the earliest opportunity.

It is probable that Section E will join with the members of the American Physical Society and other organizations in a joint session for the presentation of papers dealing with geophysics on Wednesday, December 30. If so, arrangements will be made for short field excursions on Thursday, December 31.

Arrangements have been made for special diverse route fares on the round trip identification plan, which will make it possible for geologists to purchase tickets at reduced rates from their homes direct to Tulsa, Oklahoma, for the meeting of the Geological Society of America and the American Association of Petroleum Geologists at that place from December 28 to 31 and return via New Orleans, stopping there for the meetings of Section E on January 1 and 2.

KIRTLEY F. MATHER,
Secretary

HARVARD UNIVERSITY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN APPARATUS FOR DETERMINING THE PURITY OF LIMESTONE IN THE FIELD

THE wide distribution of lime deposits, the variability in the carbonate content of the deposits, and the wide-spread use of portable grinding equipment makes the perfection of an accurate field test, whereby the purity of the stone may be determined, highly desirable. McHargue[1] and Hopkins[2] have devised an apparatus for measuring the amount of carbon dioxide produced by treating the lime with an acid. The amount of apparatus required and the difficulties encountered in calculating the results have tended to limit the application of the method.

The author has devised an apparatus which will accomplish the same result, with the same degree of accuracy and within a period of ten minutes. The entire apparatus may be carried in a small kit weighing approximately eight pounds. The essential features of the apparatus are:

(1) A 25 x 250 mm Pyrex tube, graduated in such a manner that, by the use of standardized acids and alkalies, the percentage of lime (as pure $CaCO_3$) in the sample may be read directly.

(2) A standardized acid containing an indicator, and a standardized alkali of such strength as to correspond with the volumes indicated by the graduation on the tube.

(3) A modified hydrometer equipped with a removable pan on the tip, and so constructed as to float free in the graduated tube yet will be capable of weighing one gram of limestone with an accuracy of ± 2 per cent.

The sample is weighed by dropping it on the pan of the floating hydrometer until the proper point is reached. The tube is emptied and a definite quantity of acid added. The sample is then added and, after the violence of the reaction has subsided, the height of the liquid is adjusted to a definite volume. The contents are then boiled for five minutes over an alcohol flame. The volume is again adjusted and sufficient alkali added to produce the neutral point. The graduation at the height of the total volume shows the percentage of lime. A detailed explanation of the apparatus will appear later.

PAUL EMERSON

SOILS DEPARTMENT,
IOWA STATE COLLEGE

A SIMPLE, QUICK AND INEXPENSIVE METHOD OF PREPARING LANTERN SLIDES

THE advantages of a quick method for preparing lantern slides which may be simply done and without the usual cost are especially valuable in the case of taking diagrams from a text or journal, or for producing necessary slides on short notice.

I have found the following preparation to have the above qualifications and to be very effective. Take a plain glass lantern slide, thoroughly clean it and allow to dry. When the slide has become quite dry apply a thin coat of albumin from a fresh egg and again allow the slide to dry. A smooth brush is essential in getting the coat of albumin evenly placed to avoid a streaked appearance when done.

As soon as the albumin has completely dried, place the plate with its coated side uppermost, over the diagram or other copy, and trace on the slide with India ink. The width of the lines may be varied by using pens of different sizes. Colored effects may be added in the same manner except that inks made from aniline dyes (such as the common writing fluids) should be used. The pigmentation in colored India inks make them all appear black on the screen.

Mount in the usual manner after the ink has dried by placing the newly made plate face down on another clean slide and fastening together with the usual lantern slide material or with adhesive tape.

These slides are not temporary as might be supposed but may be left in the lantern for long periods of time without injury in spite of the intense heat of some lanterns. I have used this preparation for the past five years and it is now being used by others in this department.

P. E. REID

DEPARTMENT OF PHYSIOLOGY
AND PHARMACOLOGY,
NORTHWESTERN UNIVERSITY
MEDICAL SCHOOL

SPECIAL ARTICLES

A NATURAL COPPER DEFICIENCY IN CATTLE RATIONS

A PRELIMINARY report was made at the recent meeting of the American Dairy Science Association in Davis, California, of a naturally occurring nutritional anemia of cattle in Florida. This anemia is caused by a deficiency of iron, or of iron and *copper* in the native vegetation growing on white or gray sand,

[1] J. S. McHargue, "County Agents' Calcimeter," Kentucky Agric. Expt. Sta. Circ. 9, 1915.

[2] C. G. Hopkins, "A Limestone Tester," Illinois Agric. Expt. Sta. Circ. 185, 1916.

Everglades muck, or Homestead marl soils. It does not occur on clay soils or on soils subject to overflow from clay lands. So far as known, this is the first natural copper deficiency reported.

Yearlings and heifers suckling first calves are most affected, although all ages suffer. It has been observed in sheep, goats and swine. Growth is retarded as much as one half. Reproduction is greatly impaired. This condition, known locally as "Salt Sick," has always been the cause of much loss to Florida's cattle industry. On some areas it has been impossible to keep cattle for any length of time.

Affected animals exhibit almost complete loss of appetite, emaciation, weakness and pale mucous membranes. Clay, sand, rags or dry weeds may be eaten when all feed is refused. Constipation and diarrhea in advanced cases are observed. The mortality rate has been high where cattle were not moved to healthy range or fed grain from an unaffected area.

Early workers at the Florida Agricultural Experiment Station described the post-mortem findings as identical with those of chronic tick fever (with which Salt Sick has been confused), except for the spleen. The spleen parenchyma is atrophied, the entire organ being about one quarter of its normal size. The hemoglobin of the blood often falls below four grams per cent., and the blood volume is reduced. All tissues are pale. The heart muscle is flabby and lacks tone. Otherwise the findings are those of extreme inanition.

Several hundred cases have been treated in the field. Three fluid ounces of a six per cent. solution of ferric ammonium citrate fortified with copper sulfate in molecular ratio of 50:1 given daily as a drench has been effective even in advanced cases. Two ounce doses are given to smaller animals. For prevention of the trouble and cure of less advanced cases, a lick made of 100 pounds of salt, 25 pounds of ferric oxide and one pound of copper sulfate given *ad libitum* has been found to be satisfactory.

Some hemoglobin determinations made in the field by means of a standardized Dare hemoglobinometer during the field work are as follows:

15 critical cases of salt sick	39.5 per cent.
87 visibly affected cases	60.3 " "
87 cases after one month treatment	77.2 " "
34 healthy animals in same herds	100.9 " "
185 healthy animals in unaffected areas	93.1 " "

Controlled feeding trials now in progress completely confirm the results of the field work. Iron supplements alone, even with the amount of copper present in *technical* chemicals, have proven inadequate. This may indicate a relatively high copper requirement in the bovine. Chemical and histological studies of all cases developed are being made. Tabulation of iron analyses of forage samples confirm the deficiency of iron, and copper analyses are being prosecuted.

W. M. NEAL
R. B. BECKER
A. L. SHEALY

ANIMAL HUSBANDRY DEPARTMENT,
FLORIDA AGRICULTURAL EXPERIMENT STATION

DECREASE IN RATE OF OXYGEN CONSUMPTION UNDER THE INFLUENCE OF VISIBLE LIGHT ON SARCINA LUTEA

FOR these experiments cultures of the micrococcus *S. lutea* were grown for twenty-four hours on 1 per cent. peptone agar. The organisms were then gently washed from the medium with distilled water, centrifuged rapidly, washed again and finally suspended in such a quantity of distilled water that there were approximately 5×10^8 cells in each cubic centimeter. Of this suspension, one cubic centimeter was pipetted into each of four reaction vessels of Warburg manometers;[1] one cubic centimeter was heated to boiling for a minute, made up to volume and pipetted into a fifth reaction vessel; the remainder of the suspension was used to inoculate new cultures and for other purposes. The reaction chamber of a sixth manometer contained one cubic centimeter of sterile distilled water. These vessels, into the side-arm of which a half cubic centimeter of normal base (NaOH) had been introduced, were then affixed to their respective manometers. The manometers were set in position in the water bath and allowed to shake for half an hour with open stopcocks, until temperature equilibrium. Then the stopcocks were shut; and since the base absorbed all the carbon dioxide excreted, the change in pressure registered by the manometers can be attributed wholly to the consumption of oxygen by the *Sarcina* in the closed system. The water bath was thermostatically controlled so that the temperature did not vary more than $\pm 0.02°$ C., during the course of any experiment. Illumination was provided by 10 60-w. frosted Mazda lamps arranged in two rows below the water bath, the light passing through the plate glass bottom of the tank and then nine inches of water before impinging on the reaction vessel. The two vessels in which we measured the oxygen consumption in the dark were wrapped in tin foil. The intensity of illumination was frequently controlled and found to be 556 ± 8 meter candles at the level of the vessels.

[1] O. Warburg, "Über d. Stoffwechsel d. Tumoren," 1926.

Fig. 1 shows a pair of curves drawn through the plotted data of four pairs of series, each plotted point representing the arithmetic mean of twenty

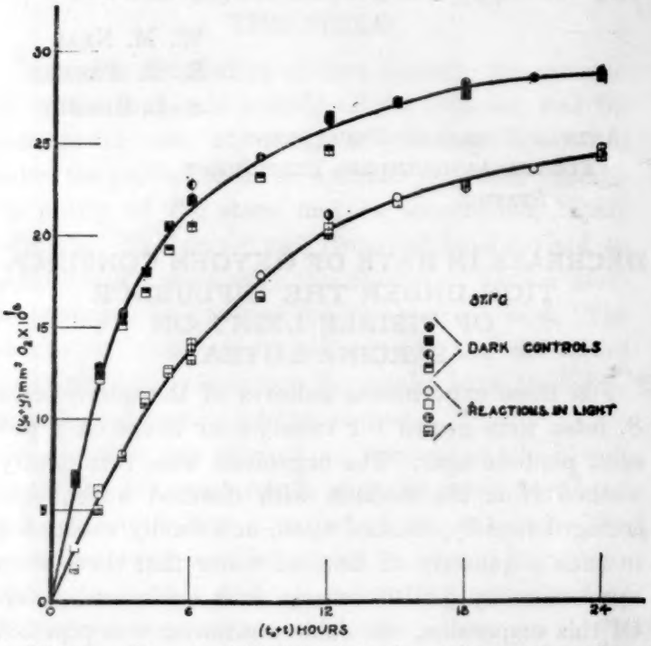

FIG. 1. Curves plotted to data from four series of experiments in distilled water and inorganic salts. Each point represents the arithmetic mean of twenty determinations. t_0 is the time elapsed between the beginning of starvation and the beginning of measurement; similarly, y_0 is the oxygen consumption during the period t_0. Both t_0 and y_0 are presented as unknown.

observations. In from 48 to 72 hours, the oxygen consumption falls off to practically nil, while the total quantity of oxygen consumed is approximately equal in the irradiated series and in the dark controls. At the end of a run, the *Sarcina* were plated out to make a count of viable organisms; the results of the counts indicate either that there had occurred no appreciable number of deaths during the period, or that the number of deaths was compensated by the appearance of an almost equal number of new organisms.

The gradual falling off in the rate of oxygen consumption is of interest, especially since we could attribute it neither to a limitation of oxygen supply nor to an accumulation of metabolites in the suspension medium. Apparently, the only substance excreted into the medium by the cells is carbonic acid; since we could find in it no traces even of fatty acids or of nitrogenous compounds. And, furthermore, if we added small quantities of fatty acids or alcohols, we found either that they did not affect the rate of oxygen consumption and were left in the suspension medium, or that they materially accelerated the rate of oxygen consumption and were taken up by the cells from the medium.

It may be noted that of the four series of data plotted, one describes the oxygen consumption of *S. lutea* in distilled water, one in phosphate buffer[2] (pH 6.5–8.0), one in half normal sodium chloride solution, and the fourth in tenth per cent. potassium cyanide solution. We could as well have plotted the data taken on the oxygen consumption of *S. lutea* in a medium of normal potassium iodide, tenth normal potassium chloride, fiftieth molar ferric chloride, or Ringer solution. The data all lie scattered along the same curves; the effects of the different ions and of the different osmotic pressures being less than the experimental error for any determination, that is, less than 3 per cent. of the mean value of twenty determinations in any other of the suspension media. Similar lack of effect of changing osmotic pressure has been reported by Falk,[3] and is discussed by Beck.[4] Thus, it appears that *S. lutea* is an organism in which the respiration is not responsive to changes in the osmotic pressure of its suspension medium; and furthermore, in which iron catalysis of respiration does not occur[5]—or if it does occur, normally, is not essential for the maintenance of cell oxidations.

By inspection, it is evident that even though the total oxygen consumption turns out to be equal in the two series, the rates of oxygen consumption diverge somewhat widely when the cells are irradiated in one case and in the other when they are shielded from light. Indeed, during the first hour, while there is apparently a quantity of light-sensitive material in the cells, the rate for the dark control (at this temperature—37.1° C.) may be as much as five times that for the irradiated organisms.

I wish to acknowledge the invaluable assistance of Dr. R. S. Lillie and Dr. R. W. Gerard, of this department.

B. B. RUBENSTEIN

DEPARTMENT OF PHYSIOLOGY,
UNIVERSITY OF CHICAGO

BOOKS RECEIVED

BRIDGMAN, P. W. *The Physics of High Pressure.* Pp. vii + 398. 87 figures. Macmillan. $5.50.

CHEMICAL CATALOG COMPANY. *Chemical Engineering Catalog, 1931.* Sixteenth edition. Pp. 1017. Illustrated. The Company.

GILLESPIE, LOUIS J. *Physical Chemistry.* Pp. ix + 287. 43 figures. McGraw-Hill. $2.75.

HOTTES, FREDERICK C. and THEODORE H. FRISON. *The Plant Lice, or Aphiidae of Illinois.* Pp. 121–447. 50 figures. 10 plates. Illinois State Natural History Survey, Urbana.

LEVENE, P. A. and LAWRENCE W. BASS. *Nucleic Acids.* Pp. 337. Chemical Catalog Company. $4.50.

MCADIE, ALEXANDER. *Airgraphics.* Pp. 37. 6 figures. Blue Hill Observatory.

[2] M. Clark, "The Determination of Hydrogen Ion."
[3] I. S. Falk, *Abstracts Bact.*, 7: 87–103, 133–147, 1923.
[4] W. A. Beck, *Plant Physiol.*, 3: 413–440, 1928.
[5] O. Warburg, *Biochem. Zeit.*, 136: 266–77, 1923.